

## THE CARYOCARACEAE AS A SOURCE OF FISH POISONS IN THE NORTHWEST AMAZON

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The Caryocaraceae is a family of tropical American trees. The family has two genera—*Anthodiscus* and *Caryocar*—with some 25 species. It is believed to be allied to the Theaceae. The family has recently been revised by Prance and Freitas da Silva (1).

### *Caryocar Allamand ex Linnaeus*

The fifteen species of *Caryocar*, trees or rarely shrubs or suffrutices (herbaceous with a woody stem base), occur in the humid tropics from Costa Rica and Colombia throughout lowland South America; the genus is particularly well represented in the Amazon and the Guianas.

The fruit and seeds of several species are valued by local populations as food, and some interest in the group has been in evidence as undeveloped plants of potential commercial value (2). Perhaps the best known is *Caryocar brasiliense* Camb. of central Brazil, the seeds of which yield an oil said to be an excellent cooking oil, a butter substitute and a source of fat for home soap-making; the fruits are used to prepare a native liqueur (3). In other parts of northern South America, the *sauri trees* or *sauri-nut trees*—*C. amygdaliferum* Mutis and *C. nuciferum* L.—are likewise the sources of edible fat, and *C. nuciferum*

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is cultivated in the West Indies for its "butter nuts" or "sauri nuts" (4). In the Guianas, *C. glabrum* (Aubl.) Pers. is known as *soapwood* and is used for washing hair and clothing (4). *Caryocar villosum* (Aubl.) Pers. likewise yields a fat similar to and used as butter and in soap-making in Brazil, where its product is called *manteiga de pequiá* ("pequiá butter"); in French Guiana, the tree is called *arbre a beurre* ("butter tree") (3); it was introduced into Malaysia in the 1920's (5), and the analysis of its fruits was reported (6).

There is some evidence from our own ethnobotanical studies in the Colombian Vaupés that *Caryocar* may have biodynamic or even toxic constituents. The Tukano Indians, for example, prepare a paste of the crushed leaves of *Caryocar gracile* Wittm. which, when fed to dogs, causes slow death within a week. *Caryocar microcarpum* Ducke appears to have insecticidal properties. The botanical explorer von Martius suggested that the root bark of a species of *Caryocar* may enter into the preparation of an Amazonian curare (7).

During the course of a plant-collecting trip to the northwestern Amazon, two of the authors (RFR and RES) observed that the leaves of *Caryocar microcarpum* are repellent, if not toxic, to leaf-cutting ants; relatively few of the insects, having attempted (and usually succeeded) in cutting pieces of leaf from a fresh collection, exhibited random, disoriented behavior and dropped leaf bits along a trail but a few yards from the site where the collection of leaves had been set out to dry; scores of the ants appeared to be dead or paralyzed and dying. These insects are responsible for enormous crop losses throughout tropical America (8).

In earlier literature, *Caryocar* is frequently cited under its local names, especially those species employed in Brazil (*piquí*, *piquí'-a*, *piquiarana*, *pequí*, *pekéa*, etc.) without reference to species identification; and the chemical studies that have been given the genus have been concerned primarily with fats and oils (9). These constituents have often been compared to olive and palm oils.

The physical properties of the oils and their glyceride compositions have been determined (10). The oil of *Caryocar villosum*

is rich in phytosterols and iron but has a bitter taste; that of *C. microcarpum* (syn. *C. butyrosu*m sensu Staehl) is marked (11). Carotenoids and significant amounts of provitamin A have been reported in piqué oils (12). Recently, de Oliveira and his co-workers found extracts of *C. brasiliense* to have some activity against Sarcoma 180, due mainly to their content of oleanolic acid; friedelin, friedelinol,  $\beta$ -sitosterol, stigmasterol and ellagic acid were also isolated (13).

With the exception of these brief notes, we are unaware of basic studies of either the chemistry or the pharmacology of this small New World plant family.

The use of *Caryocar* as a fish poison in the northwest Amazon of Brazil and Colombia is interestingly unique. A hole is dug in the ground—approximately two feet in depth. It is filled repeatedly with water, until the loose earth remaining at the base of the hole is a semi-liquid mud; it may on occasion be stirred vigorously by pounding with a piece of wood or section of a tree trunk as a pestle. Fruits of the *Caryocar* are then dumped into the hole. Pounding to mix the fruits with the mud and to crush the pericarp of the fruit is then carried on for twenty minutes or more, after which the mixture is cast into still water. The effects are rapid; the water becomes muddy or cloudy, and fish come to the surface for air and are caught by hand. During the pounding of the fruit-mud mixture and when it is thrown into the water, extensive foaming is evident, indicating a high saponin content.

Several species of *Caryocar* are employed as fish poisons by all Indian tribes in the Comisaría del Vaupés of Colombia and adjacent areas of Brazil. It is noteworthy that this method of fishing, relatively laborious in comparison with the use of the many other ichthyotoxic plants of the region, is so widespread and clearly one of the preferred procedures amongst the numerous Tukanoan tribes of the Vaupés.

The Colombian voucher specimens cited are preserved in the Economic Herbarium of Oakes Ames and/or in the Gray Herbarium (both of Harvard University) and in the Herbario Nacional de Colombia; the Brazilian specimens cited are in the collection of the New York Botanical Garden. The identifications have been checked or made by Dr. Ghilleen T. Prance;

most of the collections have been cited in the monograph by Prance and Freitas da Silva (1).

***Caryocar glabrum* (Aubl.) Persoon, Syn. Pl. 2 (1806) 84.**

BRAZIL: Estado do Amazonas, basin of Río Negro, Unciauxí, Makú Indian village 300 km. above mouth. October 1971, *Prance et al.* 15576.—Same locality. "Forest on terra firme. Tree 20 m. × 30 cm. diam. Corolla yellow; filaments purple. Fruit ground up for potent fish poison." October 24, 1971, *Prance et al.* 15583.

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Soratama. "Large tree, 75 feet. Stamens red, petals yellow. Fruit used as a fish poison." August 20, 1961, *Schultes et Cabrera* 13600.—Soratama. "Enormous tree. Flowers yellow; stamens bright red. Seeds uncooked used as foods." September 26, 1951, *Schultes et Cabrera* 14139.—Soratama. "Rind of fruit used as fish poison. Fruit light brown. Seeds eaten by natives. Wood very hard." January 28, 1932, *Schultes et Cabrera* 14999.—Portage between Ríos Vaupés and Apaporis. "Tree 15 m. In forest. Flower buds pale green. Flowers with calyx pale green; corolla pale yellow; stamens bright red, showy. Pulp of fruit used as fish poison. The seed is edible." September 17, 1976, *Zarucchi* 2090.—Río Vaupés, Between Río Paraná Pichuna and Rapids of Mandí. "Tree 13 m.; in primary forest. Fruits orange-brown, immature. Fruit pulp used as fish poison." November 12, 1976, *Zarucchi* 2223.—Río Vaupés, Raudal Tutú. "A tree. 20 m. Fruit globose, rusty brown. Seed white, edible. Rind of fruit and pulp crushed in mud holes to prepare a fish poison—it foams up." March 29, 1975, *Zarucchi, Schultes et McElroy* 1121.—Alto Río Papurí, Caño Yapú. March 31, 1977, *Patmore et Dufour* 60.

*Caryocar glabrum* is widespread in the Amazon valley and the Guianas. In the Colombian Vaupés, this tree is known in Spanish as *barbasco de monte* and *barbasco propio*. The Puinvave Indians call it *ho'-shoo* or *haw*. The Kubeos refer to the tree as *kon*. In Barasana, the name is *e-ho'*. The Makú Indians on the Brazilian Rio Unciauxí know it as *pursh*. Prance reported the use of this species as fish poison amongst the Makú (14).

***Caryocar gracile* Wittmack in Martius, Fl. Bras. 12, Pt. 1 (1886) 350.**

COLOMBIA: Comisaría del Vaupés, Río Kananarí, near mouth. "Tree in high savannah forest. Flowers pink. *Barbasco*." June 1952, *Cabrera sine num.*

*C. gracile* is not so widely distributed as many of the other species; it is known only from the northwest Amazon in the Vaupés in Colombia, in the Estado do Amazonas in Brazil and

in adjacent parts of southern Venezuela. It is known locally in Spanish as *barbasco* and is one of several species employed as a fish poison.

***Caryocar microcarpum* Ducke** in Arch. Jard. Bot. Rio Jan. 4 (1925) 133.

COLOMBIA: Comisaría del Vaupés, Río Vaupés, Miraflores. February 1944, *Gutiérrez et Schultes* 828.—Caño Guaracú. February 21, 1944, *Gutiérrez et Schultes* 867.—Río Apaporis, Soratama. "Small tree along inundated bank." June 17, 1951, *Schultes et Cabrera* 12646.—Río Kuduyarí, lowermost rapids. "Tree 60 feet. Flowers white; stamens pink. Leaves will paralyze leaf-cutting ants." October 10, 1966, *Schultes et Raffauf* 24390.—Río Kuduyarí. "Tree 10 m. tall, overhanging river. Inundated terrain. Fruit green in a terminal cluster. Seed coat spiny, imbedded in a white pulp." January 26, 1975, *Zarucchi* 1328.—Same locality. "Tree 12 m. tall, along river, inundated. *Barbasco*." August 4, 1975, *Zarucchi* 1469.—Same locality. "Tree 12 m. tall along river. Specimens collected at 10 p.m. (flowers open after dark and fall before morning). Flowers with calyx and corolla pale greenish white; stamens bright pink, fragrant. *Barbasco del río*." November 10, 1946, *Zarucchi* 2207.

The distribution of *C. microcarpum* is very extensive and probably as a result of its wide range, the species is unusually variable. It occurs in the Amazon and in Venezuela and the Guianas. However, we have been unable to find reference to its ichthyotoxic use except in the northwestern sectors of Brazil and Colombia. The Kubeo Indians of the Vaupés call this tree *kun'-kuj* and *ku'*. The Spanish names of the species are *barbasco* and *barbasco del río*, referring undoubtedly to the riparian distribution of the species.

Preliminary chemical studies have been carried out on the leaves of *C. microcarpum* (*Schultes et Raffauf* 24390). The results are summarized briefly here; experimental details will be published elsewhere. The collection gave a negative spot test for alkaloids on fresh material using Dragendorff's reagent. Hexane extraction yielded a complex mixture of triterpenes and a soft cuticular wax. Subsequent extraction with alcohol and appropriate partition of the extract followed by lyophilization gave about 40% of a powder rich in tannins of the ellagic/gallic acid type and triterpene saponins with the basic oleanane skeleton. This chemistry is certainly consonant with the native use of the leaves; saponins are known to be insecticidal and ichthyotoxic

(15); tannins are important inhibitors of the grazing of plants by herbivores of many types (16). Indeed, triterpenes of the oleanane type have been found to be toxic to termites (17) and attine ants (18). In our opinion, an assessment of *Caryocar* as a commercial crop should include further study of the non-edible portions of the plants as sources of compounds or their derivatives potentially toxic to insects.

### ***Anthodiscus* C. F. W. Meyer**

The ten species of *Anthodiscus* are trees or shrubs ranging in tropical parts of northern South America in the Guianas, Venezuela and the westernmost Amazon of Brazil, Colombia and Peru.

It is of pertinent interest that our ethnobotanical field studies indicate that several species of *Anthodiscus* are similarly employed by Indians in the Colombian Vaupés. The ichthyotoxic use of two species was reported earlier (19). Unfortunately, material of the three species known to be sources of fish poisons in the Vaupés have not been available for phytochemical study. Apparently little or nothing is known about the chemical composition of the genus (9).

***Anthodiscus obvatus* Benth** *ex Wittmack* in Martius, Fl. Bras. 12, Pt. 1 (1886) 358.

COLUMBIA: Comisaría del Vaupés, Río Apaporis, Raudal de Jerijerimo. "Small tree. Flowers yellow." November 27, 1951, *Schultes et Cabrera 14660*.—Río Apaporis, Raudal Yayacopi. "Bush. Flowers yellow." August 18, 1952, *Schultes et Cabrera 16924*.—Río Vaupés, Raudal de Yuruparí. "Small bush by falls. Sandy soil. Fish poison." August 1960, *Cabrera sine num.*

The Tukano Indians of the Colombian Vaupés, besides using this plant as a fish poison, employ it as an ingredient, together with *Strychnos*, in preparing a type of curare.

The Tanimuka name of *Anthodiscus obovatus* is *tee-fě-roo'-ka*. In the Makuna language, it is *ko-men'-tan-go* or *gaw'-we*. The Makús call it *chee-aw'*.

***Anthodiscus peruanus* Baillon** in Adansonia 10 (1872) 241.

COLUMBIA: Comisaría del Vaupés, Río Negro, Caño Ducuruapo. "Tall tree, 34-40 feet; diameter 18 inches. Wood hard, white. Bark shaggy, dark

brown. Flowers bright yellow. Leaves very glossy, light green. In caatinga." December 13-17, 1947, *Schultes et López*. 9387.

The Kuripako Indians use this tree as a fish poison.

***Anthodiscus pilosus* Ducke** in *Trop. Woods* 90 (1947) 23.

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Soratama. August 16, 1951, *Schultes et Cabrera* 13561.—Río Apaporis, Jinogojé. "On high knoll. Tree 90 feet. Flowers yellow." June 8, 1952, *Schultes et Cabrera* 16623.—Río Popeyacá, June 10, 1952, *Schultes et Cabrera* 16623.

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